MUHAMMAD SANA ULLAH

Ph.D. (CARBON SEQUESTRATION & CHANGING CLIMATE)

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Climate Change & Agro-Ecosystems Lab
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RESEARCH AREAS

- Carbon sequestration under changing climate
- Land-use changes and greenhouse gases emissions
- Microbial activities at root-soil interface
- Nutrient dynamics under abiotic stresses
- Agro-waste management for climate change mitigation

EDUCATION

2007-10 Ph. D. "Climatic influence on decomposition and stabilization of soil organic matter in grassland ecosystem with special reference to drought", University of Paris VI, France.

2006-07 Master-2-Research Science, Technology and Health, University of Paris-Est Créteil Val de Marne, France.

2004-06 Master of Science (Hons.) Soil science, University of Agriculture, Faisalabad, Pakistan.

2000-04 Bachelor of Science (Hons.), Soil sciences, University of Agriculture, Faisalabad, Pakistan.

PROFESSIONAL EXPERIENCE

2024 to date Tenured Professor, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad

2016 to date Coordinator, M.Sc. (Hons.) Climate change degree program

2019 to 2024 Tenured Associate Professor, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad

2011 to 2019 Assistant Professor, Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad

2013-15 Alexander von Humboldt (AvH) Post-doc fellowship "Effect of plant communities on nutrient cycling in soil under drought stress", University of Göttingen, Germany

DISTINCTIONS

2015-2017 Recipient of Research Productivity Award (RPA), Pakistan Council for Science and Technology

2013-2015 Recipient of Alexander von Humboldt (AvH) Post-doc fellowship, Germany

2006-2010 Recipient of HEC MPhil leading to PhD scholarship in France

CURRENT PROJECTS

- Greenhouse gases inventories of major crops of Pakistan, funded by Asian Development Bank (ADB) (840 million PKR, 2025-2029)
- Rice residue is a boon not bane, don't burn, reuse it: Evaluation to persuade farming community for mitigating smog and ensuring sustainable food production, funded by Higher Education of Pakistan (5.7 million PKR, 2022-25).

SCIENTIFIC PUBLICATIONS

Nadeem, F., A. Qadeer, **M. Sanaullah,** I. Khan, A. Rehman and M. Farooq. 2025. Integrating zinc fertilisation with conservation agriculture enhances soil health, enzyme activities, and rice productivity. Crop & Pasture Science. 76: CP25143.

Mir, R.B., **M. Sanaullah**, F. Mahmood, S. Hussain, M.H. Siddique, H.M. Ali, X. Xu, A. Ahmed, U.-e.-A. Fiaz and T. Shahzad. 2025. Interactive effects of biochar rates and elevated temperature on organic matter cycling and extracellular enzyme activity in a sandy loam aridisol. Journal of Soil Science and Plant Nutrition. 25:3056-3071.

Mujtaba, A., A. Wakeel and **Muhammad Sanaullah***. 2025. Contribution of nitrogenous sources to carbon mineralization and soil health. Soil & Environment. 44: 232-241.

Zahid, Z., T. Shahzad, **M. Sanaullah**, H.M. Ali, A. Majid and J. Száková. 2025. Comparative effect of a feedstock and its biochar on soil biochemical properties under low and optimum moisture availability in c poor and c rich soils. Journal of Soil Science and Plant Nutrition. 25:67-82.

Ashraf, M.N., I. Mehmood, Z.U.R. Farooqi, M.I. Hassan, **M. Sanaullah,** M.M. Zafar and K.M. Elhindi. 2025. Long-term grass lawn management increases soil organic carbon sequestration and microbial carbon use efficiency. Environmental Monitoring and Assessment. 197:483.

Wakeel, A., A. Qadeer, Z. Bano, M.R. Shahid, M. Rizwan, A. Kiran, **M. Sanaullah***, T. Aziz, R. M. Rees, A. Bhatia and J. Drewer. 2025. Managing Fertilizer Rates and Tillage Depth to Improve Nitrogen Use Efficiency and Soil Health. Journal of Soil Science and Plant Nutrition. 25, 2937–2947.

Anwar, F., F. Mahmood, S. Hussain, **M. Sanaullah** and T. Shahzad. 2025. Disentangling climatic and intrinsic physicochemical controls on organic carbon pools of agricultural soils along a climate gradient. The Journal of Animal and Plant Sciences. 35: 531-545.

Malik, L., S. Hussain, M. Shahid, F. Mahmood, H.M. Ali, M. Malik, **M. Sanaullah**, Z. Zahid and T. Shahzad. 2024. Co-applied biochar and drought tolerant PGPRs induced more improvement in soil quality and wheat production than their individual applications under drought conditions. PeerJ 12:e18171.

Qadeer, A., A. Wakeel, S.A. Cheema, T. Shahzad and **M. Sanaullah***. 2024. Integrated impacts of soil salinity and drought stresses on the decomposition of plant residues. Sustainability. 16:5368.

Anwar, F., **M. Sanaullah**, H.M. Ali, S. Hussain, F. Mahmood, Z. Zahid and T. Shahzad. 2024. Effect of combined application of inorganic nitrogen and phosphorus to an organic-matter poor soil on soil organic matter cycling. PeerJ 12:e17984

Afzal, T., A. Wakeel, S.A. Cheema, J. Iqbal, and **M. Sanaullah***. 2024. Influence of quality and quantity of crop residues on organic carbon dynamics and microbial activity in soil. Soil & Environment, 43: 53-64.

Rizwan, M., H. Tanveer, M.H. Ali, **M. Sanaullah** and A. Wakeel. 2024. Role of reactive nitrogen species in changing climate and future concerns of environmental sustainability. Environmental Science and Pollution Research. 31:51147-51163

Malik, L., **M. Sanaullah**, F. Mahmood, S. Hussain and T Shahzad. 2024. Co-application of biochar and salt tolerant PGPR to improve soil quality and wheat production in a naturally saline soil. Rhizosphere. 29:100849.

Shahid, M.R., A. Wakeel, **M. Sanaullah** and D.S. Gaydon. 2024. Identifying changes to key APSIM-wheat constants to sensibly simulate high temperature crop response in Pakistan. Field Crops Research. 307: 109265.

Ahmed, W., M.N. Ashraf, **M. Sanaullah**, M.A. Maqsood, M.A. Waqas, S.U. Rahman, S. Hussain, H.R. Ahmad, A. Mustafa and X. Minggang. 2024. Soil organic carbon and nitrogen mineralization potential of manures regulated by soil microbial activities in contrasting soil textures. Journal of Soil Science and Plant Nutrition. 24:3056-3067.

Noor, M., A. Kiran, M. Shahbaz, **M. Sanaullah** and A. Wakeel. 2024. Root system architecture associated zinc variability in wheat (*Triticum aestivum* L.). Scientific Reports. 14:1781.

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Haider, I., M.A. Ali, **M. Sanaullah**, N. Ahmed, S. Hussain, M.T. Shakeel, S.A.H. Naqvi, J.S. Dar, M. Moustafa, M.O. Alshaharni. 2023. Unlocking the secrets of soil microbes: How decades-long contamination and heavy metals accumulation from sewage water and industrial effluents shape soil biological health. Chemosphere. 342: 140193.

Sultana, R., A. Kiran, **M. Sanaullah** and A. Wakeel. 2023. Exploring the linkage between root system architecture and grain iron content in wheat (*Triticum aestivum* L.). Frontiers in Sustainable Food Systems. 7:1156728.

Tayyab, M., **M. Sanaullah** and A. Wakeel. 2023. Sodium substitutes potassium requirements of sugar beet under saline–sodic conditions. Journal of Plant Nutrition and Soil Science. 186:464–472.

Bushra, A. Kiran, M. Ahmad, T. Shahzad and **M. Sanaullah***. 2023. Mitigation of drought stress in

wheat through exogenous application of proline. The Journal of Animal and Plant Sciences. 33: 1392-1401.

Haider I., M.A. Ali and **M. Sanaullah**. 2023. Change in Lettuce nutrients, soil enzymes, soil microbial biomass and activities under chromium toxicity. Pakistan Journal of Botany. 55: 89-96.

Nawaz, A., H. Rehman, M. Usman, A. Wakeel, M.S. Shahid, S. Alam, **M. Sanaullah**, M. Atiq and M. Farooq. 2023. Nanobiotechnology in Crop Stress Management: An Overview of Novel Applications. Discover Nano. 18:74.

Tayyab, M., A. Wakeel, **M. Sanaullah**, S.M.A. Basra. 2023. Physiological and biochemical characterization of sugar beet against salt-stress. Pakistan Journal of Agricultural Sciences. 60: 235-247.

Iqbal, M., M. Naveed, **M. Sanaullah***, M. Brtnicky, M.I. Hussain, J. Kucerik, J. Holatko and A. Mustafa. 2023. Plant microbe mediated enhancement in growth and yield of canola (*Brassica napus* L.) plant through auxin production and increased nutrient acquisition. Journal of Soils and Sediments. 23:1233–1249.

Tayyab, M., A. Wakeel, **M. Sanaullah**, M. Zahir, M.U. Mubarak, M. Ijaz and M. Ishfaq. 2023. Foliar application of boron enhances sugar beet yield and industrial sugar content by promoting indigenous soil-boron uptake. Pakistan Journal of Botany. 55: 1295-1303.

Qadeer, A., A. Wakeel A, S.A. Cheema and **M. Sanaullah***. 2022. Interactive effects of salinity and drought stresses on soil respiration and microbial activities. Pakistan Journal of Agricultural Sciences. 59: 35-42.

Usman, M., **M. Sanaullah**, A. Ullah, S. Li and M. Farooq. 2022. Nitrogen pollution originating from wastewater and agriculture: Advances in treatment and management. Reviews of Environmental Contamination and Toxicology. 260:9.

Ullah, A., M. Farooq, A. Qadeer, **M. Sanaullah***. 2022. Impact of zinc and plant growth-promoting bacteria on soil health as well as aboveground biomass of desi and kabuli chickpea under arid conditions. Journal of the Science of Food and Agriculture. 102: 2262-2269.

Malik, L., **M. Sanaullah**, F. Mahmood, S. Hussain, M. H. Siddique, F. Anwar and T. Shahzad. 2022. Unlocking the potential of co-applied biochar and plant growth-promoting rhizobacteria (PGPR) for sustainable agriculture under stress conditions. Chemical and biological techniques in agriculture. 9:58

Iqbal, S., M. Farooq, **M. Sanaullah***, A. Ullah and F. Nadeem. 2022. Effect of nitrogen application and sorghum mulch on nitrogen use efficiency, microbial biomass carbon, extracellular enzymes activities and growth of mashbean (*Vigna mungo* (L.) Hepper). Journal of Plant Nutrition. 45:703-712.

Khan, S. N., G. Hassan, M. R. Khan, Z. H. Facho, D. Singh, K. S. Sandhu, **M. Sanaullah**, M. Imtiaz, and S. Ali. 2022. Field assessment and molecular markers-based characterization of yellow rust resistance in wheat hybrid progenies. Journal of Animal and Plant Sciences. 32:127-137.

Khan, M.I., M.J. Afzal, S. Bashir, M. Naveed, S. Anum, S.A. Cheema, A. Wakeel, **M. Sanaullah**, M.H. Ali and Z. Chen. 2021. Improving Nutrient Uptake, Growth, Yield and Protein Content in Chickpea by the Co-Addition of Phosphorus Fertilizers, Organic Manures, and *Bacillus* sp. MN-54. Agronomy. 11: 436.

B. Hussain, **M. Sanaullah**, M. Iqbal, F. Mahmood, F. Azeem, M. Shahid, T. Shahzad and S. Hussain. 2021. Effect of arsenic (AS) on growth and physiology of maize (*Zea mays*) in varying soils. The Journal of Animal and Plant Sciences. 31: 1366-1376.

Iqbal, M.M., I. Khan, **M. Sanaullah***, M. Farooq. 2021. Influence of seed size on the growth, productivity, and water use efficiency of bread wheat planted by different methods. Archives of Agronomy and Soil Science. 67: 354-370.

Sanaullah, M.*, M. Usman, A. Wakeel, S.A. Cheema, I. Ashraf and M. Farooq. 2020. Terrestrial ecosystem functioning affected by agricultural management systems: A review. Soil and Tillage Research. 196: 104464.

Rumpel, C., V. Ann, H. Bahri, M.C. Floody, S. Cheik, T.T. Doan, A. Harit, J.L. Janeau, P. Jouquet, M.L. Mora, P. Podwojewski, T.M. Tran, Q.A. Ngo, P.L. Rossi and **M. Sanaullah**. 2020. Research for development in the 21st century. Geoderma. 378:114558.

Usman, M., M. Farooq, A. Wakeel, A. Nawaz, S.A. Cheema, H. Rehman, I. Ashraf, **M. Sanaullah**. 2020. Nanotechnology in agriculture: Current status, challenges and future opportunities. Science of the Total Environment. 721: 137778.

Hussain, B., Q. Lin, Y. Hamid, **M. Sanaullah**, et al. 2020. Foliage application of selenium and silicon nanoparticles alleviates Cd and Pb toxicity in rice (*Oryza sativa* L.). Science of the Total Environment. 712: 136497.

Hussain, S., S.A. Cheema, **M. Sanaullah,** M. Farooq. 2020. Weed Management in Direct-Seeded Fine Rice Using Allelopathic Crop Residue Mulches and Nitrogen for Sustained Yields in Pakistan. International Journal of Agriculture and Biology. 24:1178-1186.

Rehman, MZ., M. Rizwan, A. Rauf, M.A. Ayub, S. Ali, M.F. Qayyum, A.A. Waris, A. Naeem and **M. Sanaullah**. 2019. Split application of silicon in cadmium spiked alkaline soil plays a vital role in decreasing Cd accumulation in rice (*Oryza sativa* L.) grains. Chemosphere. 226: 454-462.

Rasheed, N., M.A. Maqsood, T. Aziz, M.Z. Rehman, H.M. Bilal, M.A. Ayub, M. Irfan and **M. Sanaullah***. 2019. Zinc application methods affect its accumulation and allocation pattern in maize grown in solution culture. International Journal of Agriculture and Biology. 21: 1197-1204.

Mganga K., B.S. Razavi, **M. Sanaullah**, Y. Kuzyakov. 2019. Phenological stage, plant biomass and drought conditions affect enzyme activities and microbial biomass in the rhizosphere of *Enteropogon macrostachyus*. Pedosphere. 29:259-265.

Shahzad, T., F. Anwar, S. Hussain, F. Mahmood, M.S. Arif, A. Sahar, M.F. Nawaz, N. Perveen, **M. Sanaullah**, K. Rehman and M.I. Rashid. 2019. Carbon dynamics in surface and deep soil in response to increasing litter addition rates in an agro-ecosystem. Geoderma. 333:1–9.

Ahmed, M.A., **M. Sanaullah***, E. Blagodatskayad, K. Mason-Jones, H. Jawad, Y. Kuzyakov, M.A. Dippold. 2018. Soil microorganisms exhibit enzymatic and priming response to root mucilage under drought. Soil Biology and Biochemistry. 116:410-418.

Ahmed, M.A, C.C. Banfield, **M. Sanaullah***, A. Gunina and M.A. Dippold. 2017. Utilisation of mucilage C by microbial communities under drought. Biology and Fertility of Soils. 54:1-12.

Maharjan, M., **M. Sanaullah**, B.S. Razavi, Y. Kuzyakov. 2017. Effect of land use and management practices on microbial biomass and enzyme activities in subtropical top-and sub-soils. Applied Soil Ecology. 113:22-28.

Shahbaz, M., Y. Kuzyakov, **M. Sanaullah**, et al. 2017. Microbial decomposition of soil organic matter is mediated by quality and quantity of crop residues: mechanisms and thresholds. Biology and Fertility of Soils. 53:287–301.

Sanaullah, M.*, A. Chabbi, P.A. Maron, K. Baumann, V. Tardy, E. Blagodatskaya, Y. Kuzyakov and C. Rumpel. 2016. How do microbial communities in top- and subsoil respond to root litter addition under field conditions? Soil Biology and Biochemistry. 103:28-38.

Sanaullah, M*., B.S. Razavi, E. Blagodatskaya and Y. Kuzyakov. 2016. Spatial distribution and catalytic mechanisms of β-glucosidase activity at the root-soil interface. Biology and Fertility of Soils. 52:505–514.

Sanaullah, M.*, A. Chabbi, C. Girardin, J.L. Durand and C. Rumpel. 2014. Effects of elevated temperature and drought on biochemical composition of forage plants and their mineralization potential in grassland soil. Plant and Soil. 374: 767-778

Shahid, M., A. Austruy, G. Echevarria, M. Arshad, **M. Sanaullah**, et al. 2014. EDTA-Enhanced Phytoremediation of Heavy Metals: A Review. Soil and Sediment Contamination: An International Journal. 23: 389-416

Baumann, K., **M. Sanaullah**, A. Chabbi et al. 2013. Changes in litter chemistry and soil lignin signature during decomposition and stabilization of ^{13}C labelled wheat roots in three soil horizons. Soil Biology and Biochemistry 67: 55-61

Wakeel, A., M. Gul, **M. Sanaullah**. 2013. Potassium dynamics in three alluvial soils differing in clay contents. Emirates Journal of Food and Agriculture. 25: 39-44

Sanaullah, M*., A. Chabbi, X. Charrier and C. Rumpel. 2012. How does drought stress influence the decomposition of plant litter with contrasting quality in a grassland ecosystem? Plant and soil. 353:277-288

Sanaullah, M.*, A. Chabbi, C. Rumpel, and Y. Kuzyakov. 2012. Carbon allocation in grassland communities under drought stress followed by ^{14}C pulse labelling. Soil Biology and Biochemistry. 55:132-139

Sanaullah, M.*, E. Blagodatskaya, A. Chabbi, C. Rumpel, and Y. Kuzyakov. 2011. Drought effects on microbial biomass and enzyme activities in the rhizosphere of grasses depending on plant community composition. Applied Soil Ecology. 48:38–44

Sanaullah, M*., A. Chabbi, J. Leifeld, G. Bardoux and C. Rumpel. 2011. Decomposition and stabilization of root litter in top-and subsoil horizons: what is the difference? Plant and soil. 338:127–141

Sanaullah, M*., A. Chabbi, G. Lemaire, X. Charrier and C. Rumpel 2010. How does plant leaf senescence of grassland species influence decomposition kinetics and litter compounds dynamics? Nutrient cycling in agroecosystems. 88:159–171.

BOOKS/BOOK CHAPTERS

Sanaullah, M., A. Wakeel, M. S. Sajid and G. Murtaza. 2022. Proceedings of International conference on Climate Change: Impacts and solutions, published by University of Agriculture, Faisalabad Pakistan. ISBN: 978-969-8237-94-3.

Aziz, T., A. Wakeel, M.A. Watto, **M. Sanaullah**, M.A. Maqsood and A. Kiran. 2022. Nitrogen Assessment: Pakistan as a case study. Elsevier, Amsterdam, Netherlands. ISBN: 978-0-12-824417-3.

Sanaullah, M., M. Usman, H. Rehman and A. Wakeel. 2019. Proceedings of conference on Innovations in agriculture: Nourishing Pakistan in changing climate, published by University of Agriculture, Faisalabad Pakistan. ISBN: 978-969-8237-83-7.

Farooq, M., **M. Sanaullah** and I. Ashraf. 2016. Proceedings of conference on sustainable crop and animal productions systems, published by University of Haripur, Pakistan. ISBN: 978-969-7721-00-9.

Afzal, T., A. Singh, J. Iqbal, **M. Sanaullah**. 2023. Alkamides and Humic Acids: Insights into Soil Fertility. In: Mukherjee, S. and T. Aftab (Eds.). Strigolactones, Alkamides and Karrikins in Plants: Recent Updates and Future Prospects. CRC Press, UK. pp: 103-114.

Sanaullah, M., T. Afzal, T. Shahzad, and A. Wakeel. 2022. Soil organic carbon sequestration and climate change. In: Rumpel, C. (Ed.). Understanding and fostering soil carbon sequestration. Burleigh Dodds Science Publishing, Cambridge, UK. pp: 237-270.

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